

Docket No. : SHIGA7.045APC

Customer No.: 20,995

Application No. : 10/568,126

Filing Date : February 14, 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

REPLY BRIEF

Applicant : Masuda et al.

App. No : 10/568,126

Filed : February 14, 2006

For : POSITIVE PHOTORESIST
COMPOSITION AND RESIST
PATTERN FORMATION

Examiner : Chu, John S Y

Art Unit : 1795

Mail Stop Reply Brief - Patents

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Sir:

In response to the Examiner's Answer mailed **September 10, 2008**, Applicant submits this Reply Brief.

Status of the Claims begins on page 2 of this paper.

Grounds for Rejection to be Reviewed on Appeal begin on page 3 of this paper.

Appellants' Arguments begin on page 4 of this paper.

Appendix A begins on page 10 of this paper.

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STATUS OF THE CLAIMS

The status of the Claims remains unchanged since the filing of the Appeal Brief. In short, Claims 13-21 are pending in the present application, and stand rejected by the Examiner. Appellants appeal the rejection of Claims 13-21. A listing of the Claims is attached hereto as Appendix A.

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GROUND FOR REJECTION TO BE REVIEWED ON APPEAL

The Examiner has maintained the following rejections in the Examiner's Answer:

(1) Claims 13-21 under 35 U.S.C. §103(a), as allegedly being unpatentable over Bassett et al. (US 5,145,763) in view of Mizuta et al. (US 6,869,742), further in view of Lee et al. (US 2003/01655770), with the combination of Komano (US 4,847,178), Nishio et al. (US 6,010,816) and Misumi et al. (US 2003/0059706);

(2) Claims 13-21 under 35 U.S.C. §103(a), as allegedly being unpatentable over Okazaki et al. (US 5,422,221) in view of Nishi et al. (US 5,759,736), Mizuta et al., further in view of Lee et al., with the combination of Komano, Nishio et al. and Misumi et al; and

(3) Claims 13-21 under 35 U.S.C. §103(a), as allegedly being unpatentable over Mizuta et al. in view of Lee et al.

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APPELLANTS' ARGUMENTS

Appellants hereby incorporate the arguments made in Appellants' Brief mailed June 3, 2008. This Reply Brief addresses the new points of argument raised in the Examiner's Answer. For the reasons set forth below, Appellant maintains that Claims 13-21 are not obvious in view of any of the combinations of references set forth by the Examiner.

Rejections under 35 U.S.C. §103(a)

The three rejections identified above were maintained in the Examiner's Answer.

The Examiner alleges at page 10 of the Examiner's Answer that the claimed solvent blend is *prima facie* obvious, and is disclosed in the prior art when used to formulate photoresist compositions comprising photosensitive novolak resins which have been substituted (esterified) with a 1,2-naphthoquinone dizaide sulfonyl group at a rate of 3% to 7%, and having a degree of dispersion (polydispersity) of 2.2 to 2.8. The Examiner also contends that the particular percentage blend of PGMEA with ethyl lactate at a weight percent of 9:1 to 7:3 is clearly taught by Lee et al.

However, Lee only teaches that the organic solvent has no reactivity with the photosensitive compound and the novolak resin, and should have a sufficient dissolving power and an appropriate drying rate to form uniform and flat coating layer after evaporation thereof (see Lee, paragraph [0041]). Lee also teaches that when the sensitivity enhancing agent increases the solubility of the exposed portion during developing, the sensitivity restraining agent decreases the solubility of the non-exposed portion during the developing, thereby satisfying the physical properties of increasing the sensitivity and residual layer characteristic at the same time (see Lee, paragraph [0039]). Thus, Lee clearly teaches that the use of a sensitivity enhancing agent and a sensitivity restraining agent only so as to enable formation of a photoresist composition which is uniform in layer thickness and critical in dimension. One having ordinary skill in the art would have no reason to expect that the combination of these ingredients could be applied for any other purpose, including for dissolving the resin component, as in the presently claimed invention.

None of Bassett, Komano, Nishio or Misumi teach or suggest a mixed solvent of a propylene glycol alkyl ether acetate with ethyl lactate for dissolving the resin component. Further, although Mizuta teaches a combination of propylene glycol alkyl ether acetate with ethyl lactate as the organic solvent, this reference neither teaches nor suggests the specific combination of 70 to 90% by weight of a propylene glycol alkyl ether acetate with ethyl lactate as the organic solvent. In fact, Mizuta exemplifies ethyl lactate as a preferred solvent, but not propylene glycol alkyl ether acetate (see Mizuta, column 8, lines 63 to 67). Further, in all working examples of Mizuta, a mixed solvent of ethyl lactate and butyl acetate (mixing ratio of 9:1) is used. Therefore, from the teachings of Mizuta, a skilled person in the art would not have arrived at the specific organic solvent (B) used in the present invention which contains a propylene glycol alkyl ether acetate in an amount as large as 70 to 90% by weight, with an expectation of decreasing the development velocity as well as obtaining high heat resistance.

Therefore, in view of Bassett, Komano, Nishio, Misumi and Mizuta, one having ordinary skill in the art would not have been led to a mixed solvent of PGMEA and EL in a weight ratio of 9:1 to 7:3. Accordingly, there is no reason for a skilled person in the art to use a mixed solvent of PGMEA and EL in a weight ratio of 9:1 to 7:3 in order to achieve the effects taught in Lee (uniform in layer thickness and critical in dimension). Rather, in view of the teachings of paragraph [0039] of Lee, a skilled person would use a sensitivity enhancing agent and a sensitivity restraining agent with a reasonable expectation of achieving the effects taught in Lee.

In addition, in the claimed resin component, a photosensitive novolak resin (A) comprising an alkali soluble novolak resin wherein 3 to 7 mol% of hydrogen atoms within those of all phenolic hydroxyl groups of the alkali soluble novolak resin are substituted by 1,2-naphthoquinone diazide sulfonyl groups is used. In contrast, Lee discloses a novolak resin which has not been substituted with 1,2-naphthoquinone diazide sulfonyl groups as the resin component, and a naphthoquinone diazide is separately used as a photosensitizer component.

None of Okazaki, Komano, Nishio or Misumi teach or suggest a mixed solvent of a propylene glycol alkyl ether acetate with ethyl lactate for dissolving the resin component. Further, Mizuta neither teaches nor suggests the specific combination of 70 to 90% by weight of a propylene glycol alkyl ether acetate with ethyl lactate as the organic solvent. In fact, Mizuta

exemplifies ethyl lactate as a preferred solvent, but not propylene glycol alkyl ether acetate (see Mizuta, column 8, lines 63 to 67). Further, in all working examples of Mizuta, a mixed solvent of ethyl lactate and butyl acetate (mixing ratio of 9:1) is used. Therefore, from the teachings of Mizuta, a skilled person in the art would not have arrived at the specific organic solvent (B) used in the present invention which contains a propylene glycol alkyl ether acetate in an amount as large as 70 to 90% by weight, with an expectation of decreasing the development velocity as well as obtaining high heat resistance. Furthermore, Nishi neither teaches nor suggests the specific combination of 70 to 90% by weight of a propylene glycol alkyl ether acetate with ethyl lactate as the organic solvent. In fact, the mixed solvent used in the working examples of Nishi contains 21 g of ethyl lactate and 9 g of propylene glycol monoethyl ether acetate. That is, the amount of propylene glycol monoethyl ether acetate contained in the mixed solvent used in Nishi is $9 \text{ g} / (21 \text{ g} + 9 \text{ g}) \times 100\% = 30\%$, which is outside the range as recited in Claim 13 of the present application (70 to 90 %). Therefore, from the teachings of Nishi, a skilled person in the art would not have arrived at the specific organic solvent (B) used in the present invention which contains a propylene glycol alkyl ether acetate in an amount as large as 70 to 90% by weight, with an expectation of decreasing the development velocity as well as obtaining high heat resistance.

Therefore, in view of the teachings of Okazaki, Komano, Nishio, Misumi, Mizuta and Nishi, there is no reason for a person of ordinary skill in the art to use a mixed solvent of PGMEA and EL in a weight ratio of 9:1 to 7:3 in order to achieve the effects taught in Lee (uniform in layer thickness and critical in dimension). Rather, in view of the teachings of paragraph [0039] of Lee, a skilled person would use a sensitivity enhancing agent and a sensitivity restraining agent with a reasonable expectation of achieving the effects taught in Lee. In addition, as described above, Lee uses a completely different resin component.

As described above, Lee only teaches that the organic solvent has no reactivity with the photosensitive compound and the novolak resin, and should have a sufficient dissolving power and an appropriate drying rate to form uniform and flat coating layer after evaporation thereof (see Lee, paragraph [0041]). Rather, Lee teaches that the use of a sensitivity enhancing agent and

a sensitivity restraining agent enables formation of a photoresist composition which is uniform in layer thickness and critical in dimension (see Lee, paragraph [0039]).

Mizuta neither teaches nor suggests the specific combination of 70 to 90% by weight of a propylene glycol alkyl ether acetate with ethyl lactate as the organic solvent. In fact, Mizuta exemplifies ethyl lactate as a preferred solvent, but not propylene glycol alkyl ether acetate (see Mizuta, column 8, lines 63 to 67). Further, in all working examples of Mizuta, a mixed solvent of ethyl lactate and butyl acetate (mixing ratio of 2:1) is used. Therefore, based on the teachings of Mizuta, one of ordinary skill in the art would not have arrived at the specific organic solvent (B) used in the present invention which contains a propylene glycol alkyl ether acetate in an amount as large as 70 to 90% by weight, with an expectation of decreasing the development velocity as well as obtaining high heat resistance.

Therefore, in view of Mizuta teaching away from a mixed solvent of PGMEA and EL in a weight ratio of 9:1 to 7:3, there is no reason for a skilled person in the art to use a mixed solvent of PGMEA and EL in a weight ratio of 9:1 to 7:3 in order to achieve the effects taught in Lee (uniform in layer thickness and critical in dimension). Rather, in view of the teachings of paragraph [0039] of Lee, a skilled person would use a sensitivity enhancing agent and a sensitivity restraining agent with a reasonable expectation of achieving the effects taught in Lee.

Unexpected results

The Examiner dismissed Applicants' claims of unexpected results, contending that unexpected results with respect to the claimed invention over the closes prior art references had not been demonstrated. Applicants disagree with this allegation, and submit that the unexpected results presented in the Appeal Brief are sufficient to overcome any allegation of *prima facie* obviousness, even if one were present.

In the Examiner's Answer at page 10-11, section (1), the Examiner alleges that the use of the blended solvent PGMEA and ethyl lactate is not an unexpected result over PGMEA alone, based on Table 1, because of "lack of specificity of the evidence.". This is clearly incorrect, since Example 2, in which PGMEA and ethyl lactate were used, resulted in superior heat resistance compared to Example 1, in which PGMEA alone was used. Any superior, unexpected

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result is sufficient to overcome an allegation of *prima facie* obviousness, and Applicants have pointed to such a result. If the blend of PGMEA and ethyl lactate were obvious in view of the cited references, then the combination would result in the same heat resistance as PGMEA alone, which is clearly not the case.

In the Examiner's Answer at page 1, section (2), the Examiner alleges that the beneficial results of the now claimed invention was not the original intent disclosed in the specification. Specifically, the Examiner contends that the intent of the patent as disclosed in the abstract is that "the means for increasing development velocity of positive resist composition is provided..." However, this is only one intent of the invention. It should be noted that a showing of unexpected results does not require a showing that every property associated with the composition is unexpected – a single unexpected property is sufficient. According to M.P.E.P. §716.02(a)(II), "Evidence that a compound is unexpectedly superior in one of a spectrum of common properties . . . can be enough to rebut a *prima facie* case of obviousness." (Emphasis added). No set number of examples of superiority is required. *In re Chupp*, 816 F.2d 643, 646, 2 USPQ2d 1437, 1439 (Fed. Cir. 1987). Thus, the unexpected results provided in Table 1 are sufficient to overcome a *prima facie* case of obviousness, even if such a case were present.

For the reasons discussed above, Appellants respectfully request reconsideration and reversal of the rejections under 35 U.S.C. § 103(a).

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CONCLUSION

In view of the arguments presented above, Appellants respectfully request that the rejections under 35 U.S.C. §103(a) be overturned.

Respectfully submitted,

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Dated: 11/10/08

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APPENDIX A – LISTING OF CLAIMS

13. (Previously presented) A positive photoresist composition formed by dissolving (A) photosensitive novolak resin comprising an alkali soluble novolak resin wherein 3 to 7 mol% of hydrogen atoms within those of all phenolic hydroxyl groups of the alkali soluble novolak resin are substituted by 1,2-naphthoquinone diazide sulfonyl groups, wherein the alkali soluble novolak resin before substitution by 1,2-naphthoquinone diazide sulfonyl groups has been fractionated by weight to produce a degree of dispersion of 2.2 to 2.8, in (B) an organic solvent comprising 70 to 90% by weight of a propylene glycol alkyl ether acetate, and ethyl lactate.

14. (Previously presented) The positive photoresist composition according to claim 13, wherein the alkali soluble novolak resin before substitution by 1,2-naphthoquinone diazide sulfonyl groups has the following characteristics (1) and (2):

(1) a polystyrene equivalent weight average molecular weight of 1000 to 30000, and

(2) a rate of solution to a 2.38 % by weight TMAH (tetra-methyl ammonium hydroxide) aqueous solution at 23°C is 10 to 1000Å/s.

15. (Previously presented) The positive photoresist composition according to claim 13, wherein the propylene glycol alkyl ether acetate is propylene glycol methyl ether acetate.

16. (Previously presented) The photoresist composition according to Claim 13, wherein 3 to 5 mol% of hydrogen atoms within those of all phenolic hydroxyl groups of the alkali soluble novolak resin are substituted by 1,2-naphthoquinone diazide sulfonyl groups.

17. (Previously presented) The photoresist composition according to Claim 13, which further comprises (C) an alkali soluble acrylate resin.

18. (Previously presented) The positive photoresist composition according to claim 17, wherein the alkali soluble acrylate resin (C) comprises 30 to 90% by weight of a constitutional unit derived from a polymerizable compound which has an ether linkage and 50 to 2% by weight of a constitutional unit derived from a polymerizable compound which has a carboxyl group.

19. (Previously presented) The positive photoresist composition according to claim 17, wherein the molecular weight of the alkali soluble acrylate resin (C) is 10,000 to 800,000.

20. (Previously presented) The positive photoresist composition according to claim 17, wherein the amount of the alkali soluble acrylate resin (C) is more than 3 to 20% by weight, based on the photosensitive novolak resin (A).

21. (Previously presented) A resist pattern formation method comprising: coating a positive photoresist composition according any one of Claims 13 to 20 on a substrate; prebaking the coated film; selectively exposing the film; and subsequently alkali developing the film..

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